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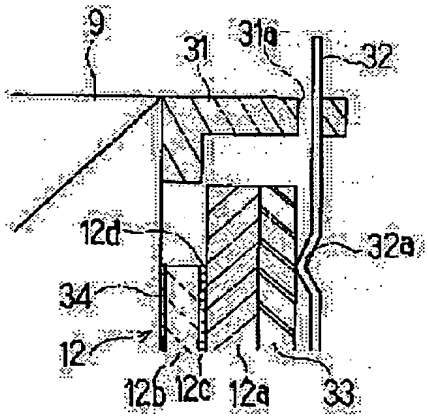
(54) PROJECTOR DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent contrast from being lowered due to double refraction and to project a high-luminance video by optically coupling the glass plate of a liquid crystal element and a prism through liquid substance.

SOLUTION: The liquid crystal element 12 is constituted by enclosing liquid crystal 12c between an integrated circuit board (IC board) 12a and the glass plate 12b. The liquid substance 34 such as silicone oil is made to intervene between the polarizing prism 9 and the element 12, and the prism 9 and the element 12 are optically coupled without being adhesively fixed. It is desirable to use liquid substance whose refractive index is as near to that of the prism 9 or the plate 12b made of glass as possible or nearly the same as that of the prism 9 or the plate 12b as the liquid substance 34. Thus, stress is hardly applied to the element 12 and influence that the contrast is lowered due to the double refraction is not exerted. Then, dust does not adhere to the surface of the element 12, yield is enhanced and the productivity of the projector device is improved.



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CLAIMS

[Claim(s)]
[Claim 1] Projector equipment characterized by to carry out optical association through the liquefied matter, without fixing said glass plate and said prism of said liquid crystal device with adhesives in projector equipment equipped with the liquid crystal device by which liquid crystal is enclosed, and modulates and outputs the light by which incidence was carried out between an integrated-circuit substrate and a glass plate, and the prism with which incidence of the light outputted from said liquid crystal device is carried out.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the projector equipment which used the liquid crystal device.
[0002]
[Description of the Prior Art] Since requests of wanting to project an image in a big screen are mounting, the projector equipment which projects an image on a screen is spreading. Drawing 3 is drawing showing the configuration of the common reflective mold projector equipment which used the liquid crystal device of a reflective mold.
[0003] For example, it is condensed with lenses 2 and 3 and incidence of the white light emitted from the lamp 1 which is a xenon arc lamp is carried out to the color-separation mirror 4. Blue (B) light penetrates the color-separation mirror 4 among the white lights by which incidence was carried out to the color-separation mirror 4, it reflects by the color-separation mirror 4, and incidence of the yellow light is carried out to the color-separation mirror 5. Among the yellow light by which incidence was carried out to the color-separation mirror 5, red (R) light penetrates the color-separation mirror 4, and incidence is carried out to a polarizing prism 9. Among the yellow light by which incidence was carried out to the color-separation mirror 5, it reflects by the color-separation mirror 5, and incidence of the green (G) light is carried out to a polarizing prism 10.
[0004] Incidence of the B light which penetrated the color-separation mirror 4 is carried out to the color-separation mirror 7 through a relay lens 6. It reflects by the color-separation mirror 7, and incidence of this B light is carried out to a polarizing prism 11 through a relay lens 8. Relay lenses 6 and 8 are for doubling the optical path length of B light with the optical path length of R light and G light. In addition, since it has already dissociated when the color-separation mirror 4 is penetrated, the usual reflective mirror may be used for B light instead of the color-separation mirror 7.
[0005] Only an S wave component reflects in the plane of composition, and incidence of the R light by which incidence was carried out to the polarizing prism 9 is carried out to the reflective mold liquid crystal device 12. It reflects by the liquid crystal device 12, and the S wave component by which incidence was carried out to the

liquid crystal device 12 turns into a P wave component, penetrates the plane of composition of a polarizing prism 9, and incidence is carried out to the synthetic prism 22. Only an S wave component reflects in the plane of composition, and incidence of the G light by which incidence was carried out to the polarizing prism 10 is carried out to the reflective mold liquid crystal device 13. It reflects by the liquid crystal device 13, and the S wave component by which incidence was carried out to the liquid crystal device 13 turns into a P wave component, penetrates the plane of composition of a polarizing prism 10, and incidence is carried out to the synthetic prism 22.

[0006] Only an S wave component reflects in the plane of composition, and incidence of the B light by which incidence was carried out to the polarizing prism 11 is carried out to the reflective mold liquid crystal device 14. It reflects by the liquid crystal device 14, and the S wave component by which incidence was carried out to the liquid crystal device 14 turns into a P wave component, penetrates the plane of composition of a polarizing prism 11, and incidence is carried out to the synthetic prism 22. In addition, as everyone knows, to liquid crystal devices 12–14, the electrical potential difference according to an image is applied, and R and G by which incidence was carried out, and B light are modulated, respectively.

[0007] R and G by which incidence was carried out to the synthetic prism 22, and B light are compounded by the synthetic prism 22, and it is projected on them by the screen which is not illustrated with a projector lens 23. Thus, an image is displayed on a screen.

[0008] Next, the installation structure of the polarizing prisms 9–11 and liquid crystal devices 12–14 in conventional projector equipment is explained. The part of a polarizing prism 9 and a liquid crystal device 12 is expanded and shown in drawing 4 . As shown in drawing 3 and drawing 4 , liquid crystal devices 12–14 have fixed to the maintenance plates 15–17, respectively. Brackets 18–20 are equipped with these maintenance plates 15–17, respectively. That is, Holes 15a–17a are formed in four corners of the maintenance plates 15–17 which are squares–like, respectively. The arms 18a–20a of brackets 18–20 are inserted in these holes 15a–17a, and the perimeter section and Arms 18a–20a of Holes 15a–17a are being fixed to them with solder 21.

[0009] In addition, after the maintenance plates 15–17 holding liquid crystal devices 12–14 have the focal location of a projector lens 23, and a relative position between liquid crystal devices 12–14 adjusted, they are fixed to polarizing prisms 9–11 by the brackets 18–20 by which adhesion immobilization was carried out. Although illustration is omitted here, between polarizing prisms 9–11 and liquid crystal devices 12–14, it considers as the dustproof structure with a RO character–like elastic body so that dust may not adhere to liquid crystal devices 12–14. Thus, adhesion immobilization of the brackets 18–20 holding liquid crystal devices 12–14 is carried out at polarizing prisms 9–11, respectively.

[0010]

[Problem(s) to be Solved by the Invention] In the conventional projector equipment explained above, since adhesion immobilization of the liquid crystal devices 12–14 is carried out at the maintenance plates 15–17, stress joins liquid crystal devices 12–14 by the difference in the coefficient of linear expansion of hardening condensation of the adhesives at the time of pasting up liquid crystal devices 12–14 and the maintenance plates 15–17, and the liquid crystal devices 12–14 and the maintenance plates 15–17. Then, the bad influence of contrast falling by the birefringence may be produced.

[0011] Moreover, since space is between polarizing prisms 9–11 and liquid crystal devices 12–14, dust may advance there. If dust adheres to the front face of liquid crystal devices 12–14, since it will become a defect, the yield worsens and the productivity of projector equipment gets worse. Consequently, the cost of projector equipment will go up. Furthermore, on the front face of polarizing prisms 9–11 and liquid crystal devices 12–14, since there is I/O of light, there is also a trouble that brightness falls several% by the optical loss by surface reflection.

[0012] It aims at offering the projector equipment which can project the image of high brightness, without making this invention in view of such a trouble, being able to prevent the fall of the contrast by the birefringence of a liquid crystal device, and dust adhering on the surface of a liquid crystal device.

[0013]

[Means for Solving the Problem] The liquid crystal device by which liquid crystal (12c) is enclosed, and modulates and outputs the light by which incidence was carried out between an integrated–circuit substrate (12a) and a glass plate (12b) in order that this invention may solve the technical problem of a Prior art mentioned above (12), In the projector equipment with which the light outputted from said liquid crystal device was equipped with the prism by which incidence is carried out The projector equipment characterized by carrying out optical association through the liquefied matter (34) is offered without fixing said glass plate and said prism of said liquid crystal

device with adhesives.
[0014]
[Embodiment of the Invention] Hereafter, the projector equipment of this invention is explained with reference to an accompanying drawing. They are the block diagram in which drawing 1 shows one example of the projector equipment of this invention, and the fragmentary sectional view which drawing 2 expands one example of the projector equipment of this invention, and is shown. In addition, in drawing 1 and drawing 2 , the same sign is given to the same part as drawing 3 and drawing 4 .
[0015] For example, it is condensed with lenses 2 and 3 and incidence of the white light emitted from the lamp 1 which is a xenon arc lamp is carried out to the color-separation mirror 4. Blue (B) light penetrates the color-separation mirror 4 among the white lights by which incidence was carried out to the color-separation mirror 4, it reflects by the color-separation mirror 4, and incidence of the yellow light is carried out to the color-separation mirror 5. Among the yellow light by which incidence was carried out to the color-separation mirror 5, red (R) light penetrates the color-separation mirror 4, and incidence is carried out to a polarizing prism 9. Among the yellow light by which incidence was carried out to the color-separation mirror 5, it reflects by the color-separation mirror 5, and incidence of the green (G) light is carried out to a polarizing prism 10.
[0016] Incidence of the B light which penetrated the color-separation mirror 4 is carried out to the color-separation mirror 7 through a relay lens 6. It reflects by the color-separation mirror 7, and incidence of this B light is carried out to a polarizing prism 11 through a relay lens 8. Relay lenses 6 and 8 are for doubling the optical path length of B light with the optical path length of R light and G light. In addition, since it has already dissociated when the color-separation mirror 4 is penetrated, the usual reflective mirror may be used for B light instead of the color-separation mirror 7.
[0017] Only an S wave component reflects in the plane of composition, and incidence of the R light by which incidence was carried out to the polarizing prism 9 is carried out to the reflective mold liquid crystal device 12. It reflects by the liquid crystal device 12, and the S wave component by which incidence was carried out to the liquid crystal device 12 turns into a P wave component, and penetrates the plane of composition of a polarizing prism 9, and incidence is carried out to the synthetic prism 22 through spacer glass 41. Only an S wave component reflects in the plane of composition, and incidence of the G light by which incidence was carried out to the polarizing prism 10 is carried out to the reflective mold liquid crystal device 13. It reflects by the liquid crystal device 13, and the S wave component by which incidence was carried out to the liquid crystal device 13 turns into a P wave component, and penetrates the plane of composition of a polarizing prism 10, and incidence is carried out to the synthetic prism 22 through spacer glass 42.
[0018] Only an S wave component reflects in the plane of composition, and incidence of the B light by which incidence was carried out to the polarizing prism 11 is carried out to the reflective mold liquid crystal device 14. It reflects by the liquid crystal device 14, and the S wave component by which incidence was carried out to the liquid crystal device 14 turns into a P wave component, and penetrates the plane of composition of a polarizing prism 11, and incidence is carried out to the synthetic prism 22 through spacer glass 43. In addition, as everyone knows, to liquid crystal devices 12-14, the electrical potential difference according to an image is applied, and R and G by which incidence was carried out, and B light are modulated, respectively.
[0019] R and G by which incidence was carried out to the synthetic prism 22, and B light are compounded by the synthetic prism 22, and it is projected on them by the screen which is not illustrated with a projector lens 23. Thus, an image is displayed on a screen.
[0020] Next, the installation structure of the polarizing prisms 9-11 and liquid crystal devices 12-14 in the projector equipment of this invention is explained. The part of a polarizing prism 9 and a liquid crystal device 12 is expanded and shown in drawing 2 . Since all of the installation structure of polarizing prisms 9-11 and liquid crystal devices 12-14 are common, using drawing 2 , it represents, and attaches with a polarizing prism 9 and a liquid crystal device 12, and structure is explained.
[0021] As shown in drawing 2 , between integrated-circuit substrate (henceforth, IC substrate) 12a and glass plate 12b called counter glass, a liquid crystal device 12 encloses liquid crystal 12c with a detail, and is constituted. The edge of glass plate 12b and IC substrate 12a are pasted up by 12d of seal sections, and liquid crystal 12c flows out.
[0022] Adhesion immobilization of the bracket 31 which has opening for passing the light from a liquid crystal device 12 to a polarizing prism 9 in a polarizing prism 9 is carried out. As an example of an elastic body, a spring 32 hooks on hook section 31a of a bracket 31, and is held at it. The spring 32 is equipped with height 32a projected in the liquid crystal device 12 direction. The spring 32 is pressing the liquid crystal device 12 through a

plate 33. As a desirable operation gestalt, height 32a of a spring 32 is pressing the location which countered 12d of seal sections. It is not necessary to paste up a liquid crystal device 12 and a plate 33.

[0023] And between the polarizing prism 9 and the liquid crystal device 12, the liquefied matter 34, such as a silicone oil, intervenes, and optical association of a polarizing prism 9 and the liquid crystal device 12 is carried out, without carrying out adhesion immobilization. As for the liquefied matter 34, it is desirable to use what has the refractive index of near and abbreviation identitas as much as possible for the polarizing prism 9 which consists of glass, or the refractive index of glass plate 12b. When the refractive index of a polarizing prism 9 differs from the refractive index of glass plate 12b, it considers as the refractive index of one of glass, and the refractive index of abbreviation identitas, or considers as the refractive index between the refractive index of a polarizing prism 9, and the refractive index of glass plate 12b.

[0024] Thus, polarizing prisms 9–11 and liquid crystal devices 12–14 are [that optical association is only carried out through the liquefied matter 34, and], and since adhesion immobilization has not been carried out using adhesives, stress hardly joins liquid crystal devices 12–14 by the difference in the coefficient of linear expansion of hardening condensation like [at the time of using adhesives], and a liquid crystal devices 12–14 and the fixed part which fixes it. Therefore, the bad influence of contrast falling by the birefringence is not produced. Since adhesion immobilization of polarizing prisms 9–11 and the liquid crystal devices 12–14 has not been carried out, exchange of liquid crystal devices 12–14 is also easy.

[0025] Moreover, since there is no space between polarizing prisms 9–11 and liquid crystal devices 12–14, dust does not advance there. Therefore, dust does not adhere to the front face of liquid crystal devices 12–14, the yield improves, and the productivity of projector equipment is improved. Consequently, it becomes possible to reduce the cost of projector equipment. Since optical association of polarizing prisms 9–11 and the liquid crystal devices 12–14 is carried out, surface reflection hardly arises on the front face of polarizing prisms 9–11 and liquid crystal devices 12–14. Therefore, it becomes possible to project the image of high brightness, without brightness falling.

[0026] In this example, although height 32a was prepared in the spring 32, a height may be prepared in a plate 33. A plate 33 may be formed by the aluminum which was excellent in the cooling effect, or you may constitute so that liquid crystal devices 12–14 may be cooled by the Peltier device. In order to carry out temporary maintenance of the plate 33 to liquid crystal devices 12–14, liquid crystal devices 12–14 and a plate 33 may be made to stick with the surface tension using the silicone grease for heat dissipation etc.

[0027] This invention can be variously changed in the range which is not limited to this example explained above and does not deviate from the summary of this invention. What is necessary is just to carry out optical association of a liquid crystal device and the synthetic prism through the liquefied matter in this example, without carrying out adhesion immobilization using adhesives, if it is transparency mold projector equipment using a transparency mold liquid crystal measure although reflective mold projector equipment was shown. Moreover, although this example showed the so-called projector equipment of 3 plate type which used three liquid crystal devices, you may be the so-called veneer-type projector equipment using one liquid crystal device.

[0028]

[Effect of the Invention] As explained to the detail above, the projector equipment of this invention The liquid crystal device by which liquid crystal is enclosed, and modulates and outputs the light by which incidence was carried out between an integrated-circuit substrate and a glass plate, Since optical association was carried out through the liquefied matter, without having equipped the light outputted from the liquid crystal device with the prism by which incidence is carried out, and fixing the glass plate and prism of a liquid crystal device with adhesives It becomes possible to project the image of high brightness, without being able to prevent the fall of the contrast by the birefringence of a liquid crystal device, and dust adhering on the surface of a liquid crystal device.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing one example of this invention.
[Drawing 2] It is the fragmentary sectional view showing one example of this invention.
[Drawing 3] It is the block diagram showing the conventional example.
[Drawing 4] It is the fragmentary sectional view showing the conventional example.
[Description of Notations]
1 Lamp (Light Source)
4, 5, 7 Color-separation mirror
9-11 Polarizing prism
12-14 Reflective mold liquid crystal device
12a Integrated-circuit substrate
12b Glass plate
12c Liquid crystal
12d Seal section
22 Synthetic Prism
23 Projector Lens
31 Bracket
31a Hook section
32 Spring (Elastic Body)
32a Height
33 Plate
34 Liquefied Matter

[Translation done.]